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INTERNATIONAL PRELIMINARY EXAMINATION REPORT

(PCT Article 36 and Rule 70)

Applicant's or agent's file reference P00131WO		FOR FURTHER ACTION See Notification of Transmittal of International Preliminary Examination Report (Form PCT/PEA/416)	
International application No. PCT/GB 02/05872	International filing date (day/month/year) 20.12.2002	Priority date (day/month/year) 20.12.2001	
International Patent Classification (IPC) or both national classification and IPC G02B5/30			
Applicant THE UNIVERSITY OF SOUTHAMPTON			
<p>1. This international preliminary examination report has been prepared by this International Preliminary Examining Authority and is transmitted to the applicant according to Article 36.</p> <p>2. This REPORT consists of a total of 6 sheets, including this cover sheet.</p> <p><input type="checkbox"/> This report is also accompanied by ANNEXES, i.e. sheets of the description, claims and/or drawings which have been amended and are the basis for this report and/or sheets containing rectifications made before this Authority (see Rule 70.16 and Section 607 of the Administrative Instructions under the PCT).</p> <p>These annexes consist of a total of sheets.</p>			
<p>3. This report contains indications relating to the following items:</p> <p>I <input checked="" type="checkbox"/> Basis of the opinion</p> <p>II <input type="checkbox"/> Priority</p> <p>III <input checked="" type="checkbox"/> Non-establishment of opinion with regard to novelty, inventive step and industrial applicability</p> <p>IV <input type="checkbox"/> Lack of unity of invention</p> <p>V <input checked="" type="checkbox"/> Reasoned statement under Rule 66.2(a)(ii) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement</p> <p>VI <input type="checkbox"/> Certain documents cited</p> <p>VII <input type="checkbox"/> Certain defects in the international application</p> <p>VIII <input type="checkbox"/> Certain observations on the international application</p>			
Date of submission of the demand 14.07.2003		Date of completion of this report 05.04.2004	
Name and mailing address of the international preliminary examining authority:  European Patent Office - Gitschiner Str. 103 D-10958 Berlin Tel. +49 30 25901 - 0 Fax: +49 30 25901 - 840		Authorized Officer Fazio, V Telephone No. +49 30 25901-647 	

**INTERNATIONAL PRELIMINARY
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International application No. PCT/GB 02/05872

I. Basis of the report

1. With regard to the **elements** of the international application (*Replacement sheets which have been furnished to the receiving Office in response to an invitation under Article 14 are referred to in this report as "originally filed" and are not annexed to this report since they do not contain amendments (Rules 70.16 and 70.17)*):

Description, Pages

1-19 as originally filed

Claims, Numbers

1-16 as originally filed

Drawings, Sheets

1/13-13/13 as originally filed

2. With regard to the **language**, all the elements marked above were available or furnished to this Authority in the language in which the international application was filed, unless otherwise indicated under this item.

These elements were available or furnished to this Authority in the following language: , which is:

- ☐ the language of a translation furnished for the purposes of the international search (under Rule 23.1(b)).
☐ the language of publication of the international application (under Rule 48.3(b)).
☐ the language of a translation furnished for the purposes of international preliminary examination (under Rule 55.2 and/or 55.3).

3. With regard to any **nucleotide and/or amino acid sequence** disclosed in the international application, the international preliminary examination was carried out on the basis of the sequence listing:

- ☐ contained in the international application in written form.
☐ filed together with the international application in computer readable form.
☐ furnished subsequently to this Authority in written form.
☐ furnished subsequently to this Authority in computer readable form.
☐ The statement that the subsequently furnished written sequence listing does not go beyond the disclosure in the international application as filed has been furnished.
☐ The statement that the information recorded in computer readable form is identical to the written sequence listing has been furnished.

4. The amendments have resulted in the cancellation of:

- ☐ the description, pages:
☐ the claims, Nos.:
☐ the drawings, sheets:

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5. ☐ This report has been established as if (some of) the amendments had not been made, since they have been considered to go beyond the disclosure as filed (Rule 70.2(c)).

(Any replacement sheet containing such amendments must be referred to under item 1 and annexed to this report.)

6. Additional observations, if necessary:

III. Non-establishment of opinion with regard to novelty, inventive step and industrial applicability

1. The questions whether the claimed invention appears to be novel, to involve an inventive step (to be non-obvious), or to be industrially applicable have not been examined in respect of:

☐ the entire international application,

☒ claims Nos. 16

because:

☐ the said international application, or the said claims Nos. relate to the following subject matter which does not require an international preliminary examination (specify):

☐ the description, claims or drawings (*indicate particular elements below*) or said claims Nos. are so unclear that no meaningful opinion could be formed (*specify*):

☐ the claims, or said claims Nos. are so inadequately supported by the description that no meaningful opinion could be formed.

☒ no international search report has been established for the said claims Nos. 16

2. A meaningful international preliminary examination cannot be carried out due to the failure of the nucleotide and/or amino acid sequence listing to comply with the standard provided for in Annex C of the Administrative Instructions:

☐ the written form has not been furnished or does not comply with the Standard.

☐ the computer readable form has not been furnished or does not comply with the Standard.

V. Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement

1. Statement

Novelty (N)	Yes: Claims	5,6,8,9,11-14
	No: Claims	1-4,7,10,15
Inventive step (IS)	Yes: Claims	
	No: Claims	1-15
Industrial applicability (IA)	Yes: Claims	1-15
	No: Claims	

2. Citations and explanations

see separate sheet

Re Item I

Basis of the report

Reference is made to the following documents:

D1: EP-A-0 526 269;

D2: SVIRKO Y ET AL: 'Layered chiral metallic microstructures with inductive coupling' APPLIED PHYSICS LETTERS, 22 JAN. 2001, AIP, USA, vol. 78, no. 4, pages 498-500, XP002247228.

Re Item V

Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement

1. Novelty (Art. 33(2) PCT)

1.1. The subject-matter of present independent claim 1 is not novel over the disclosure of document D1, which discloses an optical device (optical display, page 2, line 1) comprising (page 3, lines 43-47; figure 1a and 5a-5d; claim 1) a planar layer (5) of a first material, the layer being formed with a pattern of one or more shaped elements (4), the or each shaped element having no line of symmetry within the plane of the layer, i.e. being 2D-chiral.

The additional feature of claim 1 ("such that an optical signal incident on the device is reflected and/or transmitted and/or diffracted by the device, and at least one of the polarisation state, intensity and phase of the optical signal is changed as a result of its interaction with the device") is not a technical feature of the invention, but rather attempts to define the invention by a result to be achieved by it (see also Guidelines C-III, 4.7).

Even if that functional language was to be considered necessary because the invention could not be defined otherwise, it is pointed out that the same result, i.e. the manipulation of the polarization state and the absorption of the electromagnetic radiation, is also achieved by the optical device of D1 in a large range of optical wavelengths, from radio-waves to visible-waves (page 2, lines 2-4; page 2, lines 37-39; page 4, lines 13-14; claim 1). D1 discloses a general theory (page 4, lines 15-54) of how chiral elements, because of their lack of symmetry, can rotate the polarization of light and can absorb electromagnetic waves (page 4, lines 13-14), where the dimensions of the chiral shaped elements are chosen as a function of the wavelength, again radio-waves to visible-waves, of the electromagnetic waves (page 3, lines 2-4).

The subject-matter of present claim 1 is therefore not novel.

1.2. D1 further discloses:

- the device further comprising a substrate layer (10) of a second material having different

electromagnetic properties to the first material, the substrate layer supporting the layer of the first material (page 3, lines 48-49; figure 1a) [claim 2];

- the first layer being formed with at least one shaped chiral motif, which implicitly includes a pattern comprising a plurality of shaped elements [claim 3];
- the or each shaped element being a chiral shaped element (4), such as a spiral (figure 1a) or a bi-layered chiral shaped element (figure 5d) (a form similar to that of a split-ring is also disclosed in figure 1b) [claim 4];
- the first layer (5) comprising (page 5, lines 39-41) a layer of a conducting material, as for instance a metal as copper [claim 7];
- the optical device further comprising a third layer (12) (figures 5c and 5d) in the form of (page 4, lines 6-8) a layer of a polymer material or a ceramic material (i.e. electrically insulating materials), or of sapphire or silica (i.e. a dielectric material), the third layer being provided between the substrate layer (10) and the first layer (5) [alternatively, layer (5) can be seen as the third layer and layer (12) as the first layer, the layer (5) being on top of the layer (12)] [claim 10];
- the device further comprising (page 5, lines 29-31; figure 6) a plurality of planar layers with a pattern of one or more shaped elements [claim 15].

Therefore, the subject-matter of claims 2-4, 7, 10 and 15 is not novel.

2. Inventive step (Art. 33(3) PCT)

2.1. The additional features of the claims 5, 6, 8, 9 and 11-14, by which the subject-matter of those claims differs from that of D1, do not involve an inventive step, for the following reasons:

- claims 5 and 12: the point of the invention is to have a 2D-chiral layer; the fact that non-chiral shaped elements being arranged in a pattern having planar chirality give rise to a 2D-chiral layer is known to the skilled person in the art of chirality and would therefore be regarded it as an obvious alternative option to the pattern of 2D-chiral elements of D1, which the applicant himself admits in the description (page 6, line 32-page 7, line 2) [claim 5]; another obvious option is to use a layer of a chiral material which would be intrinsically 2D-chiral (see also D2, figure 1) [claim 12];

- claim 6 (see paragraph 3.1. below): option (i): D1 discloses the fabrication of solid shape chiral elements on the first layer by photolithography with a positive resist and it is very well known to the skilled person that the use of a negative resist with the same mask would create a chiral hole in the first layer; option (ii): the same feature is described in document D2 (figures 1 and 2) as providing the same advantages as in the present application and the skilled person would therefore regard it as a normal option to include this feature in the device described D1;

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- claim 8: the first material being ferromagnetic, ferroelectric, piezoelectric, electro-optic, magneto-optic, photo-acoustic or electro-acoustic are merely straightforward possibilities from which the skilled person would select, in accordance with circumstances, without the exercise of inventive skill; the additional feature of claim 8 ("to thereby allow at least one of the polarisation state, intensity, phase or direction of the transmitted, reflected and/or diffracted light to be changed") is not a technical feature of the invention, but rather attempts to define the invention by a result to be achieved by it, results which is also achieved by the optical device of D1 (see for instance page 2, lines 37-39; page 4, lines 13-14) (see also paragraph 1.1. of this communication);

- claim 9: the substrate layer of a second material comprising a layer of a crystalline material or a layer of a semiconductor material are also merely straightforward possibilities from which the skilled person would select, in accordance with circumstances, without the exercise of inventive skill;

- claim 11: the optical device further comprising a layer of a surrounding material provided on top of the first layer, the surrounding layer extending into and substantially filling any holes present in the first layer is also an obvious choice for the skilled person because these kinds of fillings or protective layers are widely used in thin film technology;

- claim 13: one or more of the first material, the second material, the material of the third layer and the surrounding material having sharp excitonic adsorption lines to enhance the optical properties of the device has already been disclosed in D2 (page 500, right column, lines 16-19) the skilled person would therefore regard it as a normal option to include this feature in the device described D1;

- claim 14: D1 discloses the first layer (5) and the second layer (10) being made of metallic or semiconducting materials (page 3, lines 52-54; page 5, lines 39-41) with the third layer (12) in between (figure 5e) made of a dielectric material (page 4, lines 6-8), which constitutes a tunnel junction within a shaped element; the other tunnel junctions mentioned in the claim are very well known in the art and therefore the skilled person would pick any of them without exercise of inventive skill.

Therefore, the subject-matter of claims 5, 6, 8, 9, 11-14 is not inventive.